

# Carbon in United States Forests and Wood Products, 1987-1997: State-by-State Estimates

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# Purpose of Study

- Assist states in compiling greenhouse gas inventories for the forest sector
- Raise awareness of forest carbon accounting issues
- Identify common sources of information and methods
- Quantify approximate contribution of forestry sector for each state

# Project Outputs

- Comprehensive report available (soon)
- Web site with data tables by region and state (now)
- Limited ability to provide custom analysis or guidance on methodology

## Carbon in United States Forests and Wood Products, 1987-1997: State-by-State Estimates

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**Table 1-- Total carbon stock on forestland and harvested wood products in the United States, and annual change by accounting component, in Mt<sup>1</sup>.**

Accounting component	1987	1997	Avg. change per year 1987-97
Biomass	15,833.2	16,838.1	100.50
Forest floor and coarse woody debris	9,401.3	9,455.6	5.43
Soils	28,421.6	28,663.5	24.19
Wood products and landfills	2,919.6	3,520.4	60.08
Total	56,575.7	58,477.6	190.19

<sup>1</sup>Million metric tons.

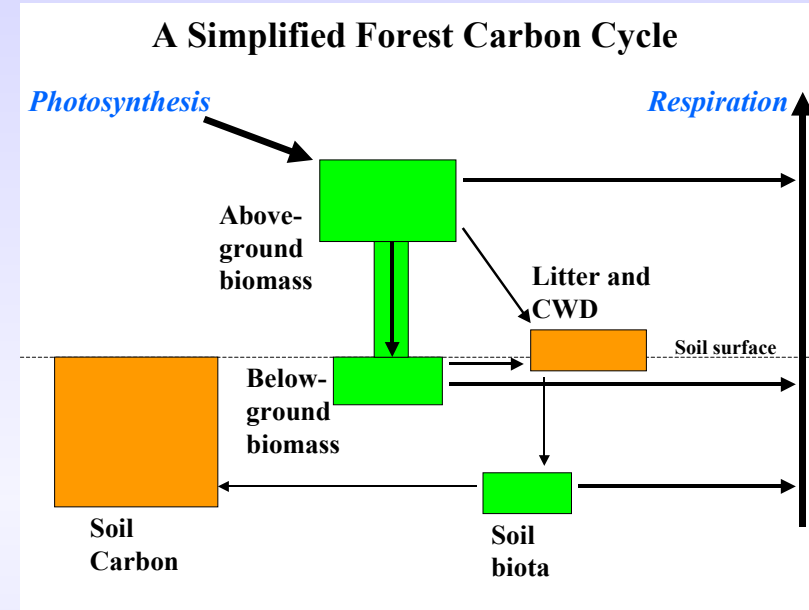
**Table 2-- Total carbon stock on forestland and harvested wood products in the United States, and annual change by owner, in Mt.**

Owner group	1987	1997	Avg. change per year 1987-97
National forest	11,703.5	12,245.6	54.22
Other public	13,482.4	13,345.5	-13.69
Forest industry	5,696.8	5,559.1	-13.77
Nonindustrial private	25,693.1	27,327.4	163.43
Total	56,575.7	58,477.6	190.19

# Forest sector carbon accounting

- Multiple components to track:

- Biomass
- Soil carbon
- Coarse woody debris
- Forest floor
- Wood products
- Landfills

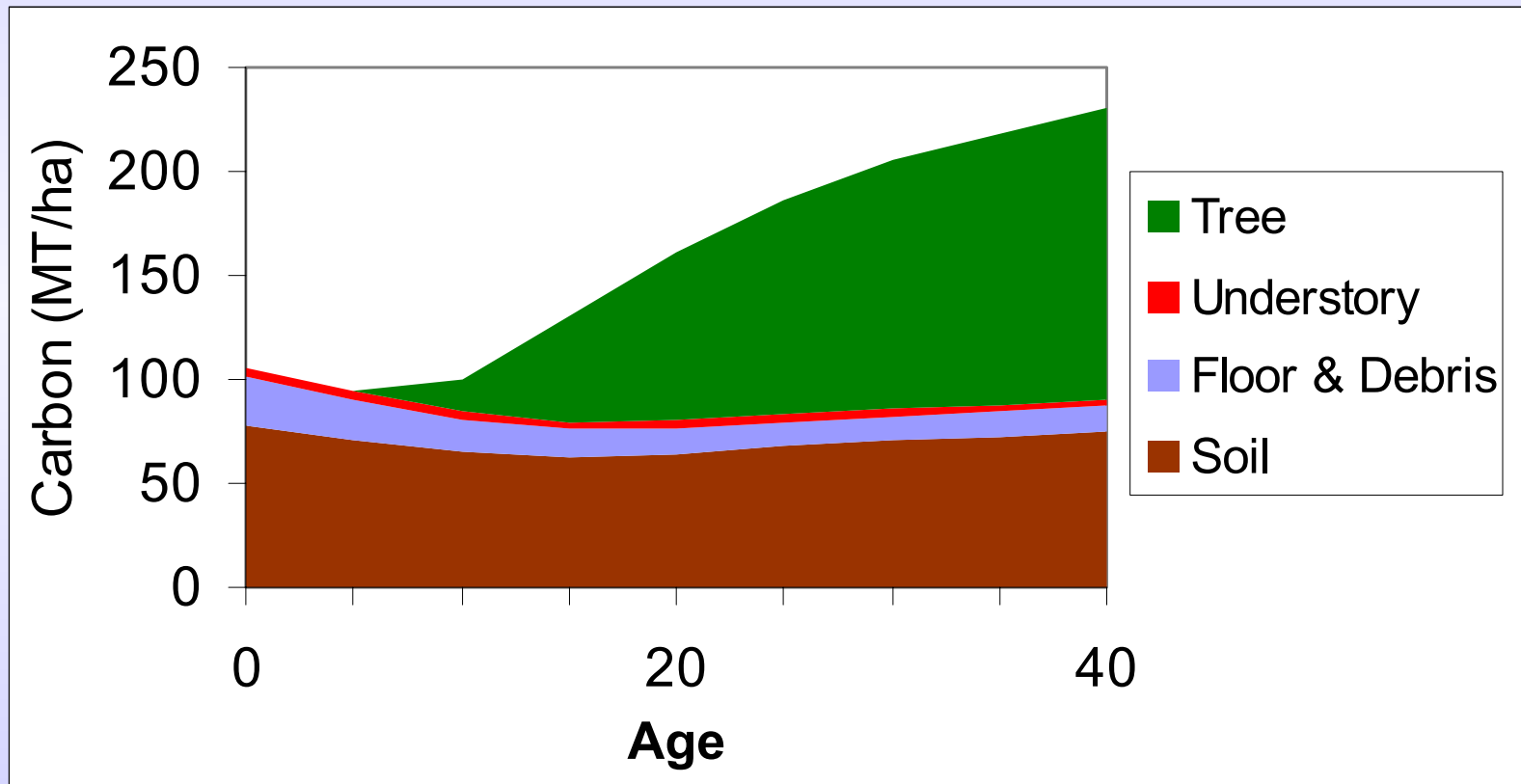


- Disturbances:

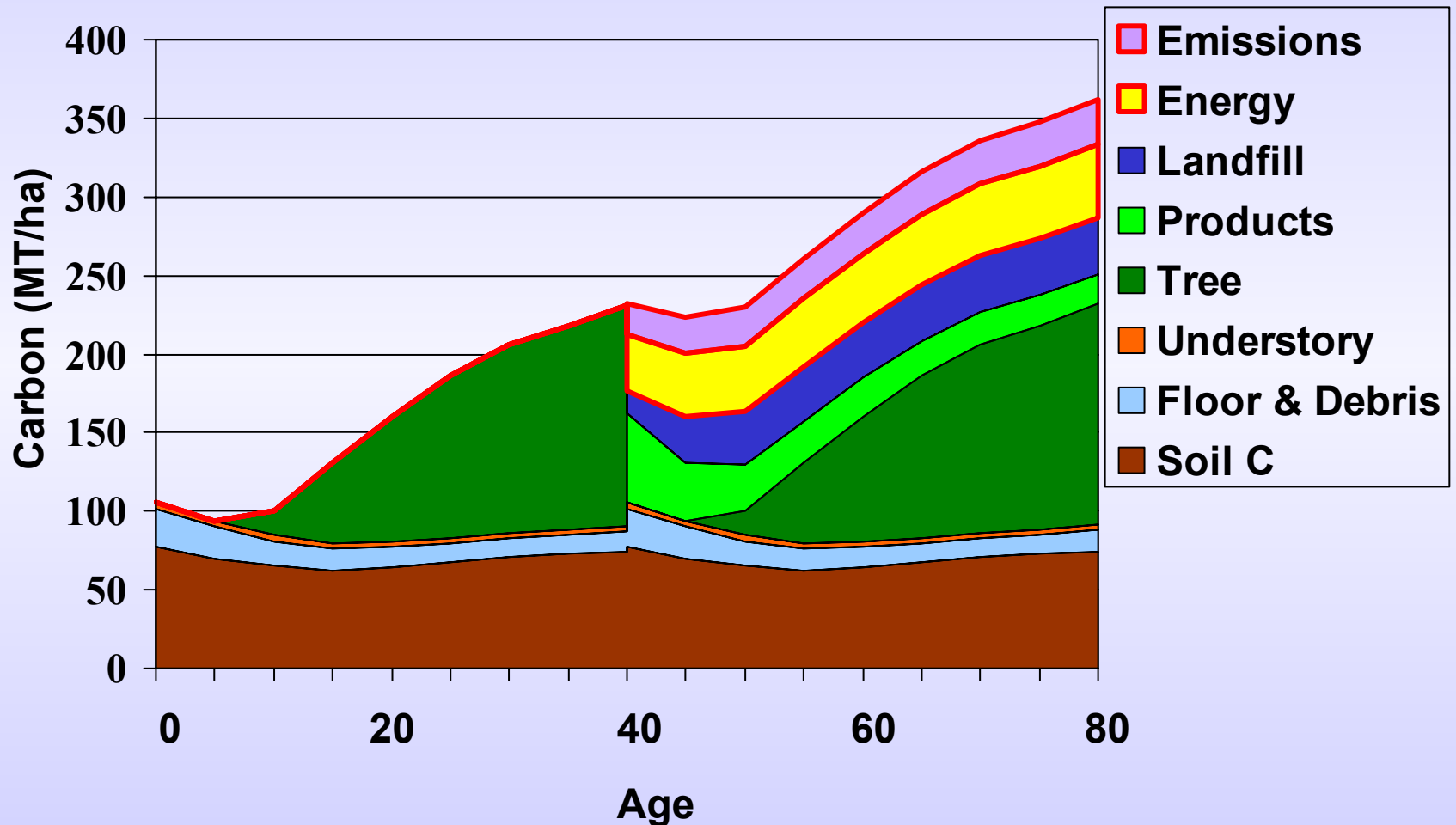
- Land use change
- Harvesting
- Mortality



## Example: Average forest C budget for one rotation of pine on a high site in the SE

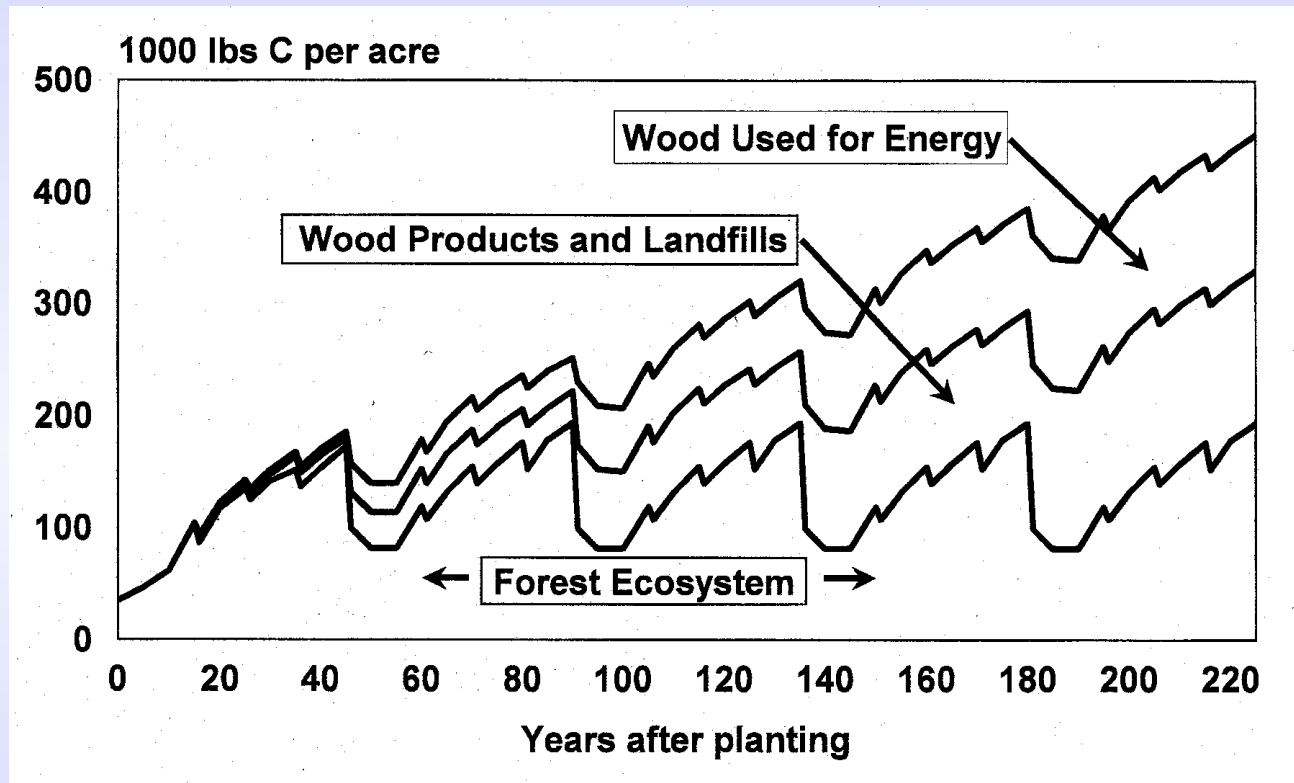


## Example: Two rotations of pine on a high site in SE Forest C and disposition of C in harvested wood



NOTE: Energy and emissions are releases of C to the atmosphere

# How Forest Sector Carbon Stocks Change Over Time



- Carbon in managed forests has a repeatable pattern
- Including wood products may produce a long-term increase

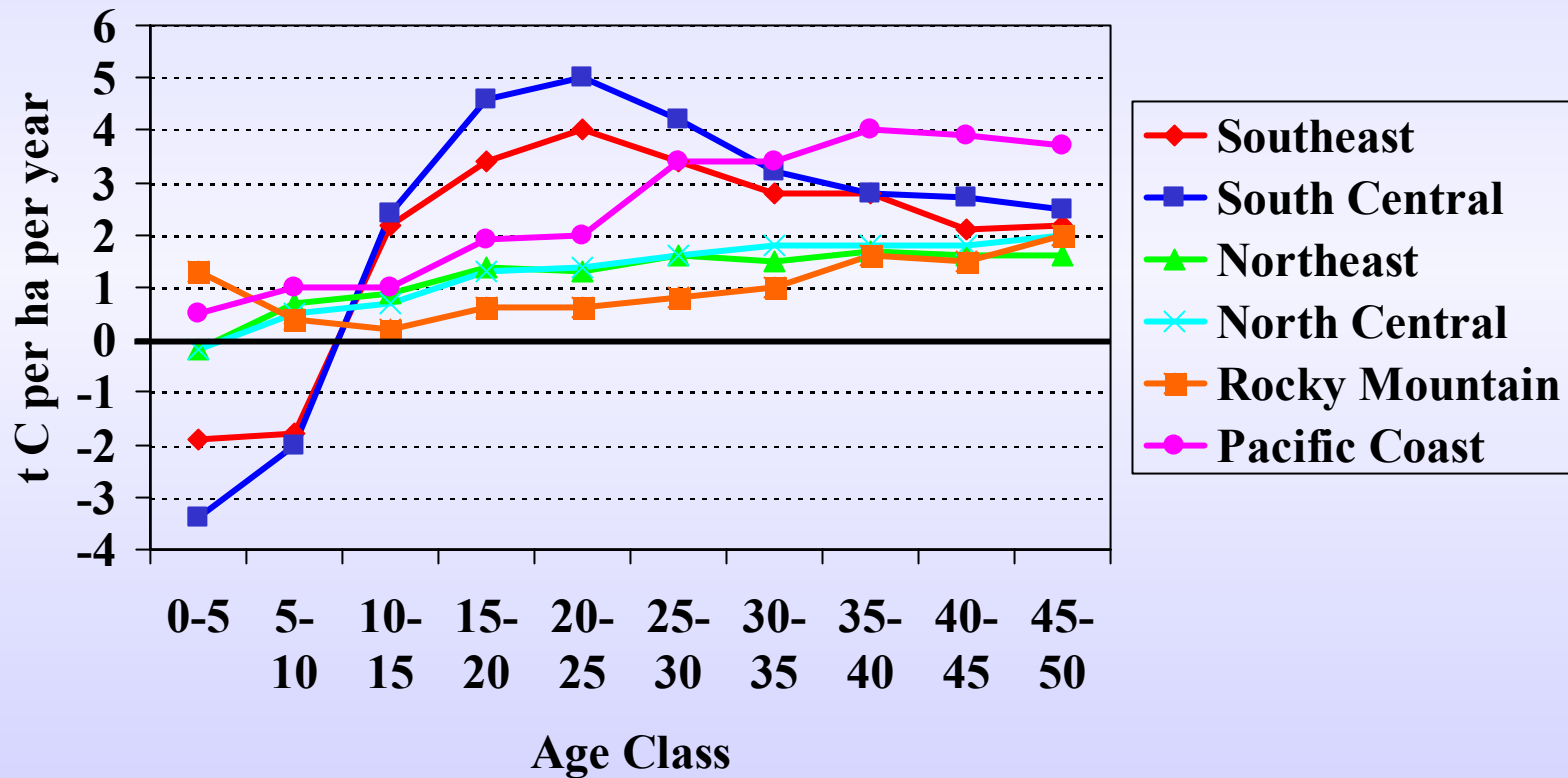






# Average C Uptake on Land by Region and Age - Regeneration After Harvest

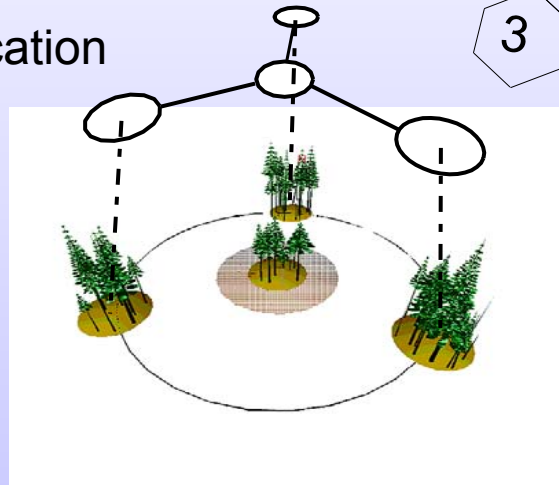
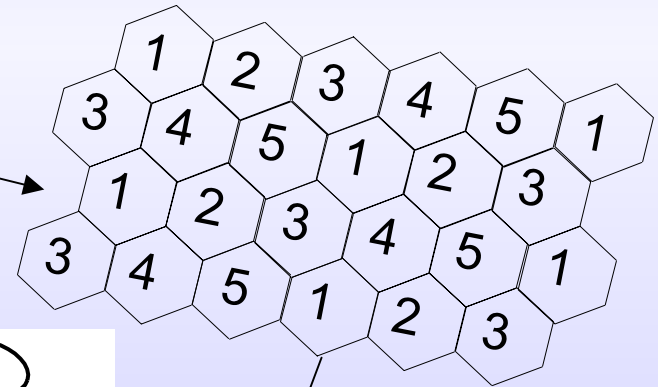
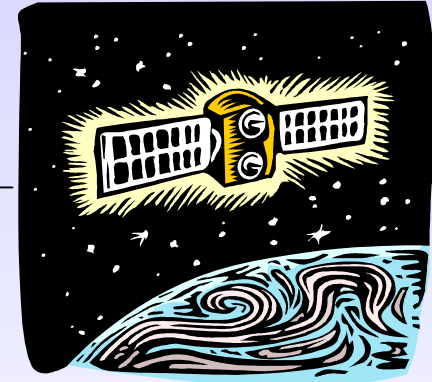
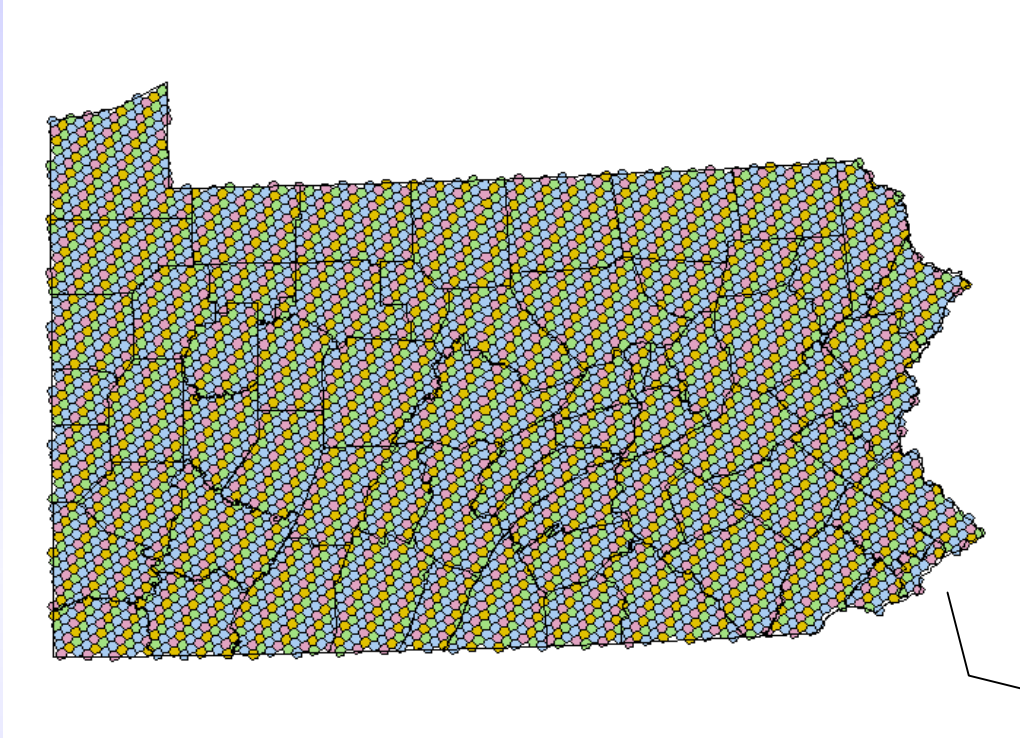
(Includes decay of logging debris)



# Basic estimation of carbon stocks and stock changes

- Carbon stock = CARBON/AREA times AREA
- Carbon stock change =  
C stock at time 2 minus C stock at time 1  
Divide by length of period = carbon/year
- Estimated values can be obtained from measured data or from using models

# The Forest Inventory



Sample Intensity = 1 sample location  
per 6,000 acres of land

Inventory Cycle Length =  
Five years or 20 percent  
of the sample locations  
each year

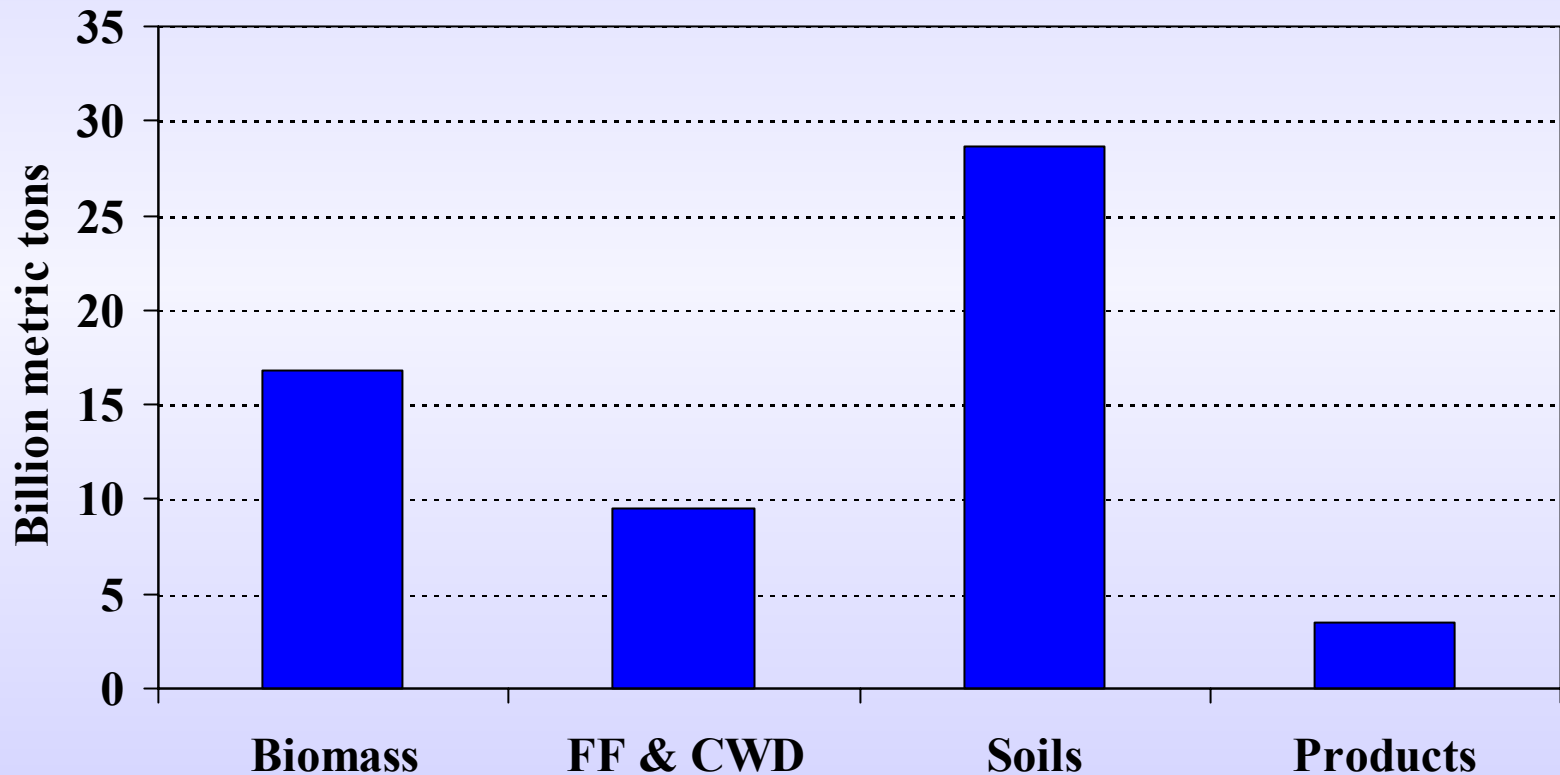
# **Forest Inventory Estimates as a Basis for Carbon Analysis**

## **(Trends by State and Region)**

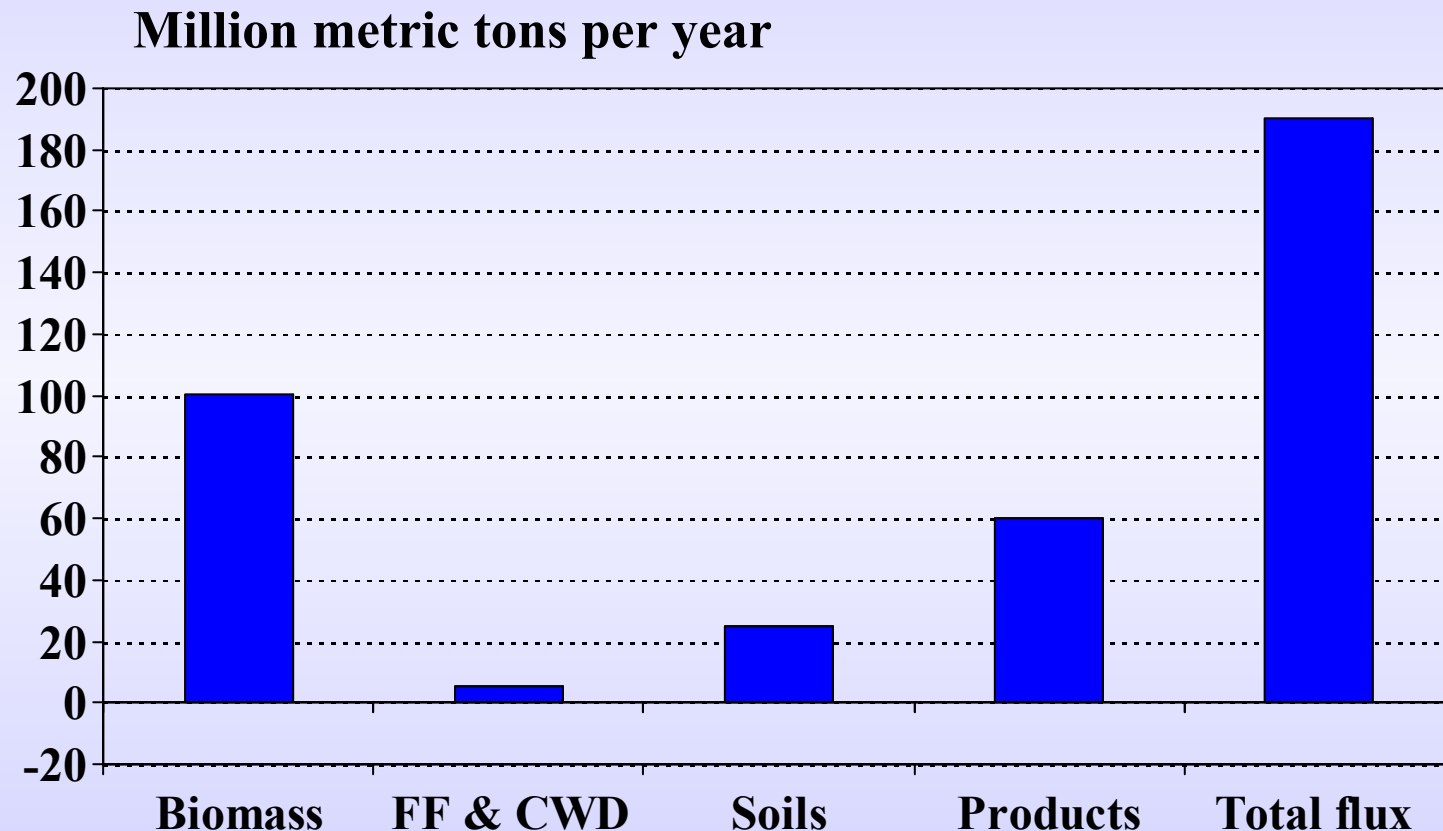
- Area by land class (reconciled with NRI)
- Area by forest type, owner, age class
- Tree volume by species and size class
- Tree biomass by species and size class

# Carbon Stock on Forestland and Wood Products of the U.S., 1997

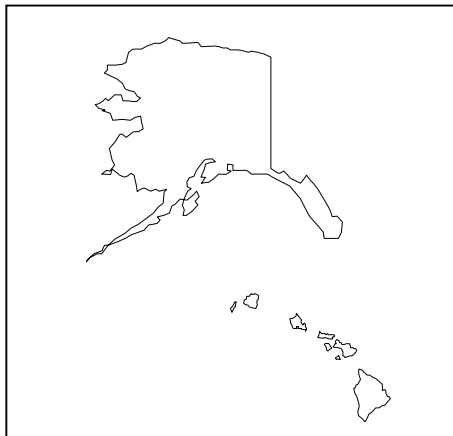
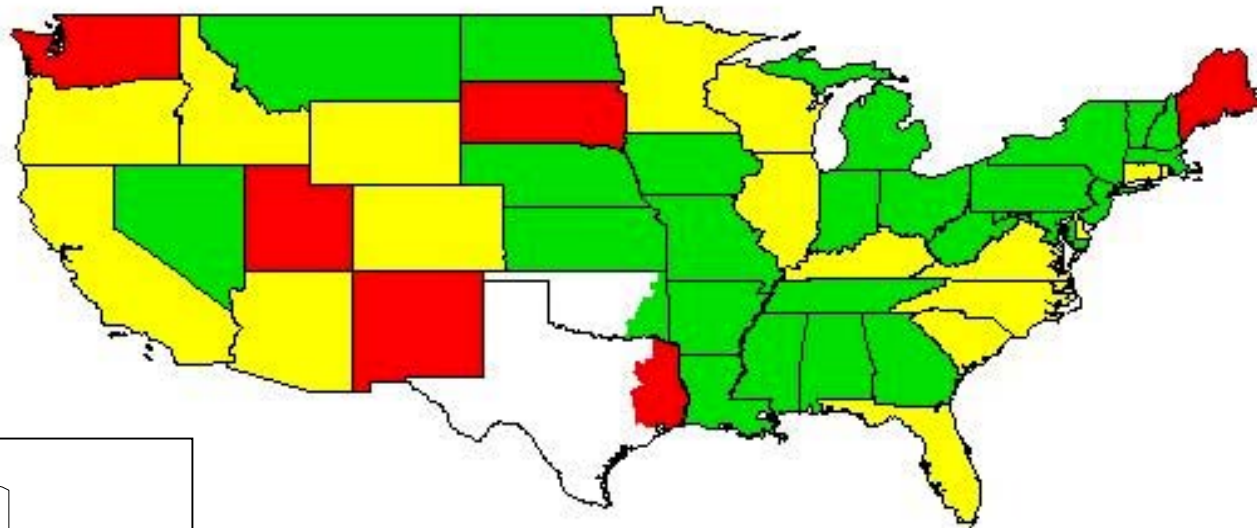
(Total stock estimated to be 57 billion metric tons)



# Change in Carbon Stocks on Forestland and Wood Products of the U.S., 1987-97



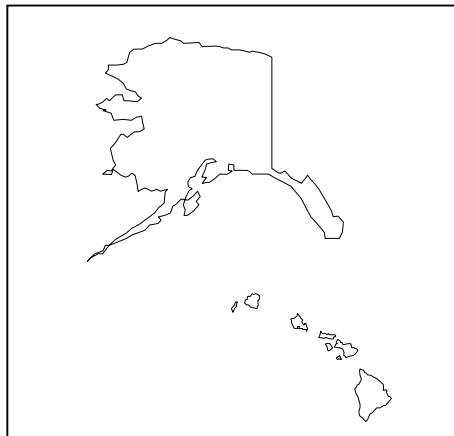
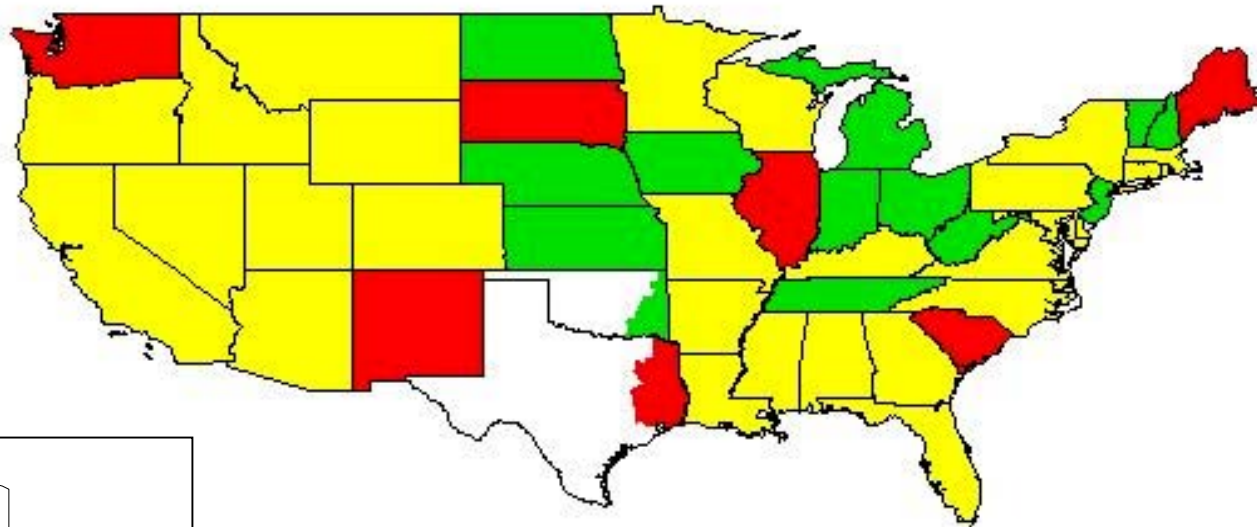
# Rate of Change in Forest Sector Carbon Stocks, 1987-97



Tons/hectare/yr  
-3.246 - 0  
0 - 1  
1 - 4.376

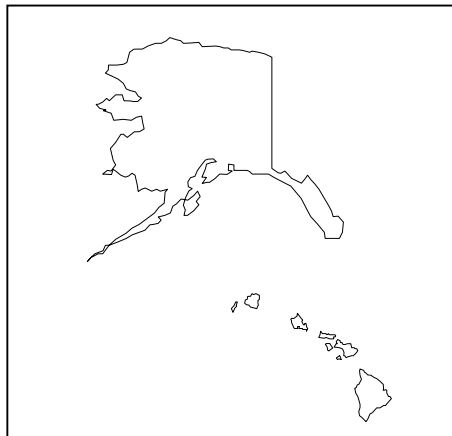
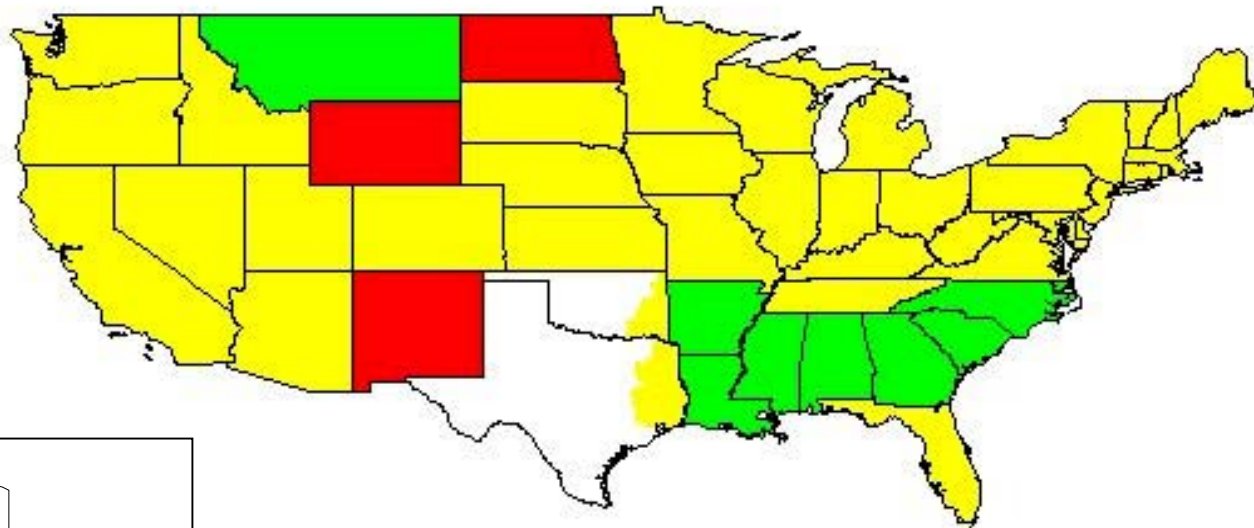


# Rate of Change in Forest Biomass Carbon Stocks, 1987-97



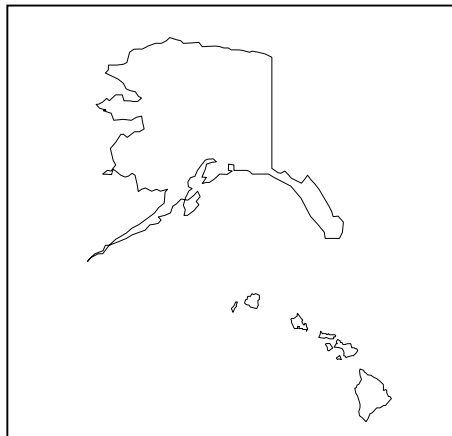
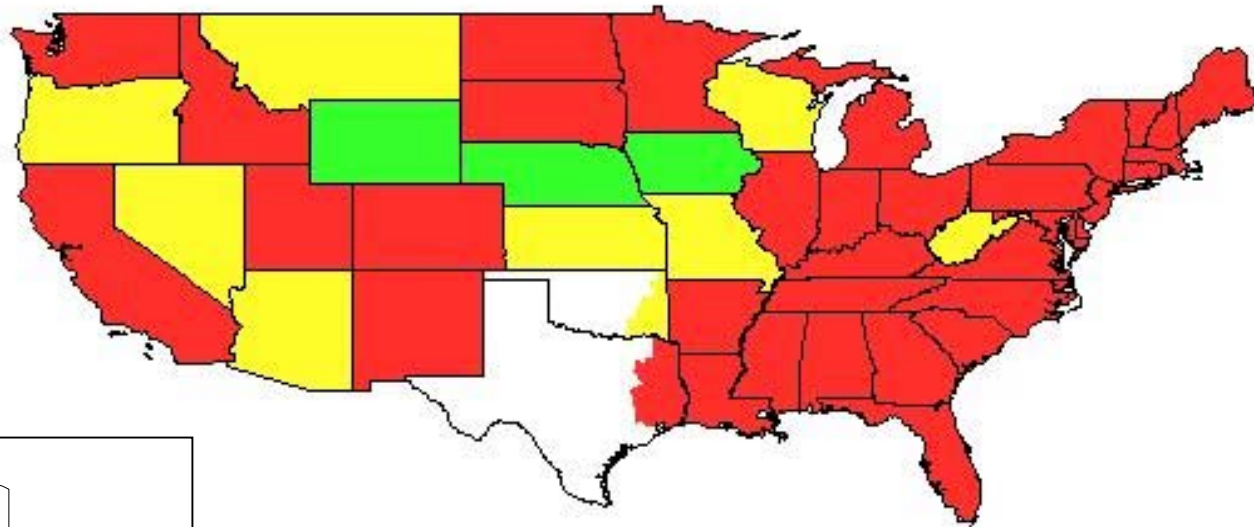
Tons/hectare/yr  
-0.831 - 0  
0 - 1  
1 - 2.351




# Rate of Change in Wood Product Carbon Stocks, 1987-97



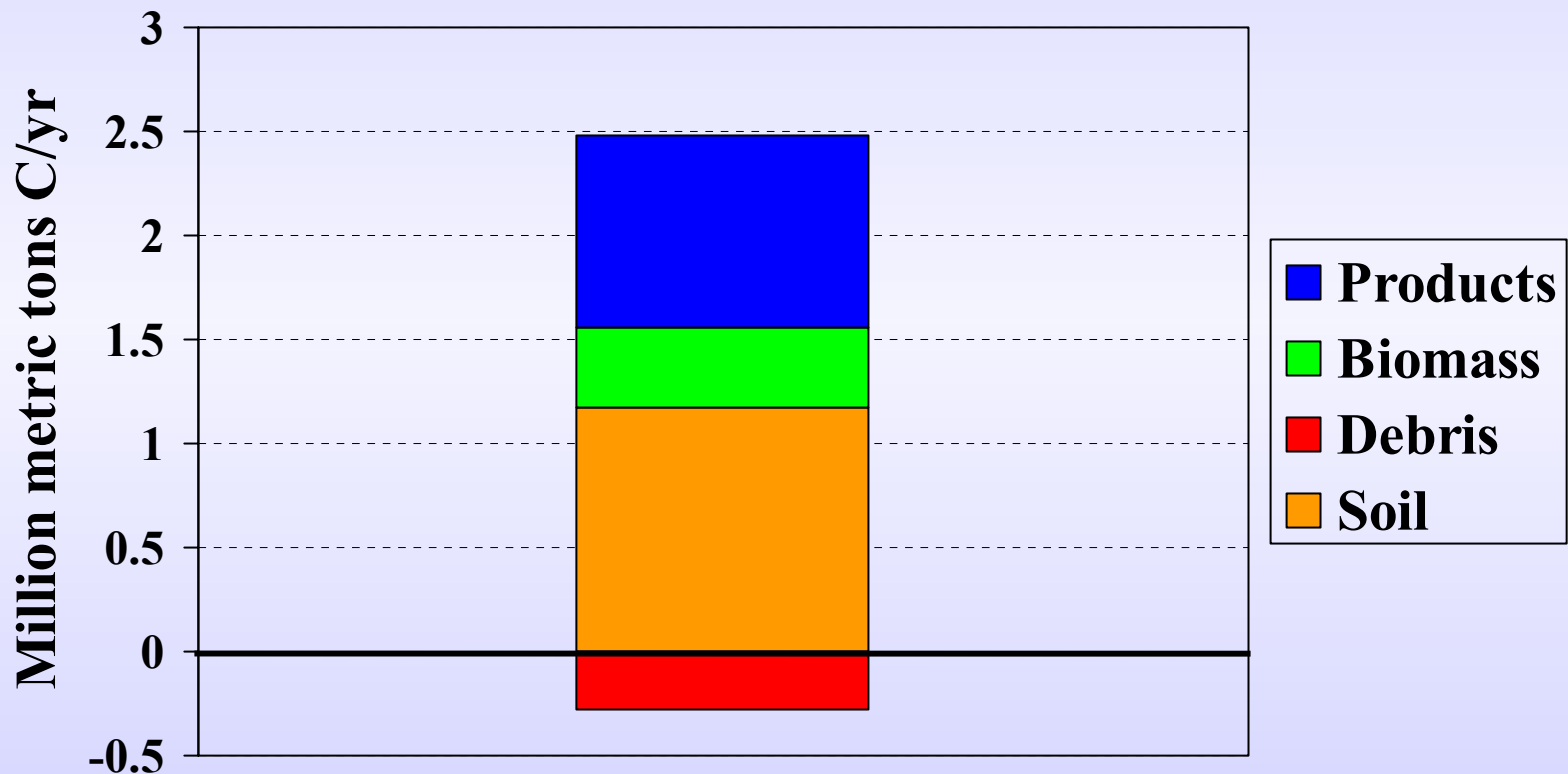
Tons/hectare/yr  
-0.185 - 0  
0 - 0.35  
0.35 - 0.616

# Rate of Change in Total Carbon Stocks from Land-use Change, 1987-97



**Tons/hectare/yr**  
 -1.823 - 0  
 0 - 0.1  
 0.1 - 0.189

# Carbon Sequestration by the Forest Sector of Pennsylvania, 1987-1997

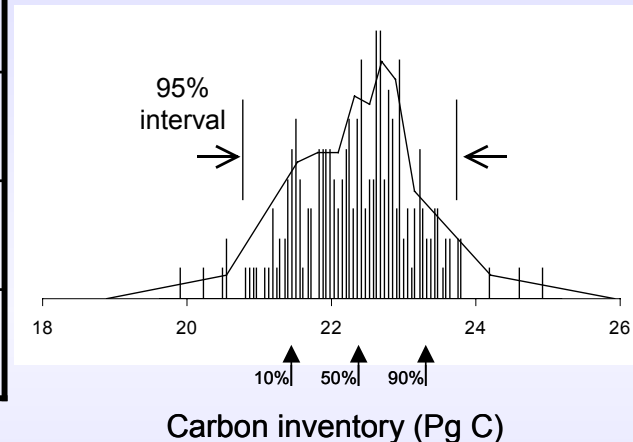


NOTE: land use change contribution = -1 MMTC/yr

# Confidence in Carbon Estimates at Regional Scale

Live biomass	Good
Woody debris and litter	Fair
Soil organic matter	Poor
Wood and Ag Products	Fair

(Heath and Smith 2000)



➤ **Research needs:** efficient protocols for extensive monitoring; enhanced network of long-term intensive study sites; improved models and analysis

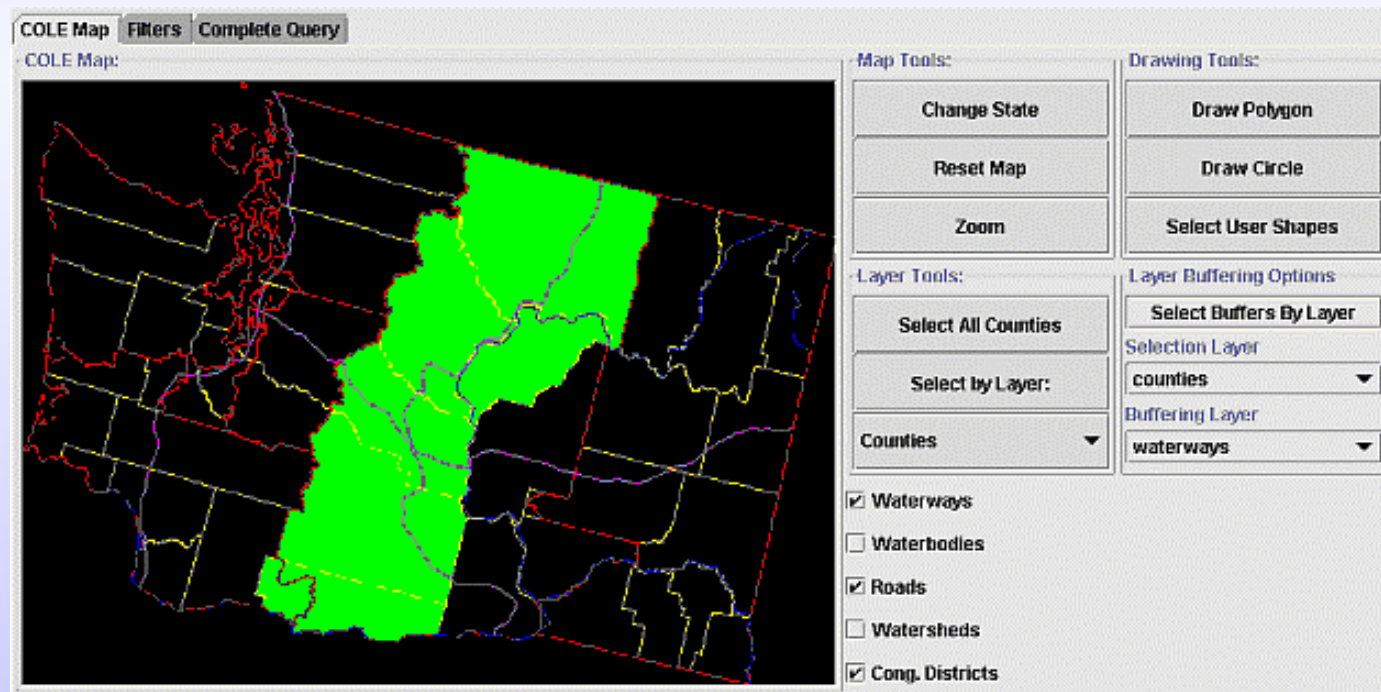
➤ **Implementation need:** not all lands are monitored effectively for changes in ecosystem C

# Recommendations for States

- Talk with your forestry experts
- Use these estimates as a starting point
- Identify factors that make a difference in forest carbon stocks
- Review data availability
- Review and adapt methods
- Make estimates and have them reviewed

# What's next? Carbon On-Line Estimator

- Custom data retrievals and carbon estimates
- User-specified tables, maps, geographic areas
- Linkage with up-to-date inventory data
- Latest estimation methodology





# The Current and Potential Role of Forests in Sequestering Carbon

- Currently, U.S. forests sequester carbon at a rate that is 15% of U.S. emissions
- It is technically feasible to increase the rate of carbon sequestration in forests by 150 MMTC/yr
- Voluntary incentive program are under consideration
- Research, monitoring, and landowner assistance would be required for forest carbon sequestration to be enhanced

# Internet Resources:

- <http://www.fs.fed.us/ne/global/>
  - U.S. and state-level carbon estimates
  - Carbon estimation methodology
  - Global change research information
- <http://ncasi.uml.edu/COLE/>
  - Beta-test version of Carbon On-Line Estimator

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